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HETEROECISMAL UREDINEÆ.

BY WILLIAM TRELEASE.

Of late years, most mycologists who have paid any attention to the rust-fungi have had more or less to say about the connection of æcidial forms on the one hand, with teleutosporic forms on the other; and cultures have been tried by experimenters of all grades of skill, with a view to connecting isolated forms of both sorts. As a result, the botanical literature of the last decade or two is filled with notices on the subject, ranging from speculations based on the simultaneous occurrence of two forms, to evidence accumulated in an experimental way by such men as De Bary, Cornu and Magnus.

Since Deslangchamps suggested, in 1862, that Gymnosporangium fuscum might be genetically connected with Roestelia cancellata, Oersted, Cornu, and Magnus have instituted cultures the published results of which show that species of these genera are in reality alternating generations complementary one to the other; yet it should be noted that in this country, where they reach their largest numbers, cultures by Farlow have given only negative or contradictory results, while Rathay has had no better success in Europe.

The experiments of Scholer on Aecidium berberidis, in the early part of the century, and the later and better ones by De Bary, Cornu, Schroeter, and many others, have apparently proved that a number of species of Puccinea and Uromyces are connected with æcidia (often scarcely distinguishable themselves) living on other host-plants, whose only connection with those bearing the teleutospores is cohabitation. Still the number of unconnected æcidial and teleutosporic forms is now large—a fact especially true of America, where cultures have not been resorted to; and even in Europe it is doubtful whether anything is gained by attempts to classify the species with reference to their life-history.

One of the latest papers on heteroecism is by Rostrup (*Revue mycologique*, October, 1884), and contains a number of statements which will interest American students. Puccinia suaveolens, the fragrant rust of the Canada thistle, is joined to the heteroecismal species, although its alternating generations occur on different plants of the same host, Puccinia phragmitis, a rust common on the reed, and morphologically easy of recognition, seems far from being one of the simplest, since Nielsen and Rostrup claim, as the result of cultures, that its æcidium occurs on Rumex and Rheum, while Cornu produced an æcidium on Ranunculus repens as the result of infection with its teleutospores; so that a strict application of the logic of heteroecism must necessitate the recognition of two species in place of one. Another curious thing about the reed-rust is, that Puccinia magnusiana, a species morphologically different from the last, also produces cluster-cups on Rumex and Rheum, which cannot be readily separated from those of P. phragmitis, when taken by themselves.

Caeoma, a genus usually placed with the isolated uredo and æcidial forms, is said by Rostrup to be, at least in part the æcidial stage of Melampsora, which has heretofore been supposed to have no æcidium, if we except the sub-genus Calyptospora. C. euonymi, C. ribesii, and C. mercurialis are respectively connected with M. caprearum, M. hartigii (in part), and M. tremulæ, as the result of experiments; while a species similar to, if not identical with, the last named, is said to cause the development of Cæoma pinitorquum when sown on pines—a fact which, if true, renders intelligible the greater abundance of the Cæoma in the vicinity of aspens, as observed in Jutland.

As now understood, the truly heteroecismal species are brought together in the following list:

TELEUTOSPORIC FORMS.	ÆCIDIA.
Chrysomyxa ledi, (A. & S.)	Æcidium abietinum, A. & S.
" rhododendri	" "
Coleosporium senecionis (P.)	Peridermium pini (Willd.)
Gymnosporangium clavariæforme (Jacq.)	Rœstelia lacerata (Sow.) " penicillata (Sow.)
Gymnosporangium juniperinum (L.)	" cornuta, Gmel.
" sabinæ (Dicke.)	" cancellata, Rebent.
Melampsora caprearum, DC	Cæoma euonymi.
" gœppertiana (Kuehn.)	Æcidium columnare, A. & S.
" hartigii, Thuem	Cæoma ribesii, Lk.
" tremulæ, Tul	" pinitorquum, A. Br.? " mercurialis.
Puccinia arundinacea, DC	Æcidium ranunculacearum, auct.
" caricis, (Schum.)	" urticæ, Schum.
" coronata, Cda	" rhamni, Gmel.
" dioicæ, Magn	" jacobææ, Grev
" eriophori, Thuem	" cinerariæ, Rostr.
" graminis, P	" berberidis, Gmel.
" limosæ, Magn	Cæoma lysimachiæ, Schl
" magnusiana, Koern	Æcidium rubellum, Gmel
" moliniæ, Tul	" orchidearum, Desm.
" phragmitis. Schum	" rubellum, Gmel.
" poarum, Niels	" tussilaginis, Gmel.
" rubigo vera (DC.)	" asperifolii, P.
" sesleriæ, Reich	" rhamni, Gmel.
" sessilis, Schn	" alli ursini, P.
" silvatica, Schr	" taraxaci, Schm. & Kze.
Uromyces dactylidis, Otth	" ranunculacearum, auct.
" junci (Desm.)	" zonale, Duby.
" pisi (Pers.)	" euphorbiæ, Gmel.
" poæ, Rabh	" ficariæ, P.